**Supplementary Note 2**

Least Square Support Vector Machine (LSSVM), as described previously ([1](#_ENREF_1)), is derived from Support Vector Machine (SVM). LSSVM solves linear equations, and provides vast computational advantages in a wide spectrum of scientific research areas ([2-7](#_ENREF_2))*.*The following MATLAB codes are an example of implementation of LSSVM for growth curve of *Escherichia coli* dataset including growth modeling, calculation of absolute error (MAE) and mean absolute percentage error (MAPE), and finally data visualization:

IMPORTANT NOTE: Install “LS-SVMLAB version 1.8” toolbox (<http://www.esat.kuleuven.be/sista/lssvmlab>) ([8](#_ENREF_8)) before running the codes.

1. **Growth modeling**

%%Modeling data, T=time, Y=ln(N(t)/N0)

Tm=[0; 0.5; 1; 1.5; 2.50; 3; 3.5; 4; 5; 5.5; 6; 6.5; 7.5; 8; 8.5; 9; 9.5; 10; 11; 11.5; 12.5; 13;];

Ym=[0; 0.0763; 0.105; 0.356; 1.316; 1.901; 2.2946; 2.648; 2.8517; 2.9436; 3.05055; 3.1159; 3.19705; 3.23898; 3.25809; 3.2834; 3.30578; 3.3282; 3.3568; 3.37; 3.3873; 3.391;];

%%Test data, T=time, Y=ln(N(t)/N0)

Tt= [2; 4.5; 7; 10.5; 12];

Yt= [0.732; 2.757; 3.1505; 3.33954; 3.38250];

%% Training of LSSVM model using ‘*c*’ and ‘σ’ coefficients that obtained from NSGA-II, 117453.1 and 0.50, respectively. Please note that in the LSSVM model ‘σ2’ should be used.

c=117453.1;

s2=0.50^2;

%%Since LSSVM can be applied for classification and calculation of regression, 'f' defines the regression mode.

[alpha,b]=trainlssvm({Tm,Ym,'f',c,s2,'RBF\_kernel'});

%% Calculation values of *E. coli* growth using LSSVM approach for modeling data.

Ysim = simlssvm({Tm,Ym,'f', c,s2, 'RBF\_kernel'} ,{alpha,b},Tm);

1. **Calculation of MAE and MAPE**

%% Calculation of MAE and MAPE for modeling data.

MAPE=100\*sum(abs(Ym-Ysim)./mean(Ym))/length(Ym)

MAE=sum(abs(Ym-Ysim))/length(Ym)

%% Calculated values of *E. coli* growth via LSSVM approach for test data.

Ysimt = simlssvm({Tm,Ym,'f',c, s2, 'RBF\_kernel'},{alpha,b},Tt);

%%Calculation of MAE and MAPE for test data.

MAPEt=100\*sum(abs(Yt-Ysimt)./mean(Yt))/length(Yt)

MAEt=sum(abs(Yt-Ysimt))/length(Yt)

1. **Data visualization**

%%Plotting of predicted and observed growth values for the modeling data.

figure(1)

subplot(2,1,1)

plot(Tm,Ysim);

hold on

plot(Tm,Ym,'r')

hold off

%%Plotting of predicted and observed growth values for the test data.

figure(1)

subplot(2,1,2)

plot(Tt,Ysimt);

hold on

plot(Tt,Yt,'r')

hold off

**Reference**

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